SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems II (2)

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STUDY ON THE LOW COST GAS-GENERATOR SOLID PROPELLANT (GGP) FOR THE LAUNCH VEHICLE SIDE JET

Abstract

Japanese launch vehicle, M-V rocket was employed the solid motor side jet (SMSJ) system which was loaded the low temperature gas generator solid propellant (GGP). The advanced solid launch vehicle, Epsilon rocket is under development, and will also be equipped the same type of the side jet system. For the Japanese launch vehicle, the SMSJ system is still important. Considering the development trend of the recent date for the space launch systems, the improvement of their subsystems cost is important point of view for the space use. Since SMSJ system for M-V operated with the metal valve to control the jet direction, the gas temperature should be suppressed to prevent the metal fusion. Therefore, the single purpose propellant was developed for this system. The composition of GGP is quite different from the main propulsion system, and it is composed of the fuel rich system. The hydrocarbon material in GGP works as a coolant by the endothermic chemical decomposition. For the advanced system, GGP composition should be changed because of their high production cost. The cause of this problem is that the coolant material is the special-purpose material. Ammonium Nitrate (AN) is a popular oxidizer for the pyrotechnics and explosives, and AN is also widely used for the agricultural industry as a chemical fertilizer. Therefore, AN is one of the inexpensive materials. In this research, the approach of the cost suppression is the application of AN as a propellant component. However, it is difficult to apply for the solid propellant oxidizer without any innovation. In other words, the crystalline transformation with the alteration in volume and the hygroscopicity of AN are incompatible for it. In early papers, the phase stabilized techniques have been reported to improve the crystalline transformation of AN. That is called Phase-stabilized AN (PSAN) which is the mixture of AN and potassium nitrate. For the solid propellant application, the particle shape of PSAN should be controlled for the closest packing in the propellant. In the present research, AN based composite solid propellant was studied for the development of the advanced low cost GGP. The combustion properties of the improved GGP were also estimated experimentally. The fine spherical particle of PSAN for the propellant was manufactured experimentally with the subscale equipment. The PSAN particle sample was estimated by the thermochemical analysis. This paper will mainly discuss about the combustion properties of the improved GGP.